

CLAIMS

- 1 1. A method for updating a qtree stored in a coalesced persistent consistency point
2 image (PCPI) of one or more qtrees, the method comprising the steps of:
3 transitioning from a stable state to an unstable update state as an update procedure
4 commences;
5 transitioning from the unstable update state to a done state in response to the up-
6 date procedure succeeding;
7 transitioning from the unstable update state to an unstable rollback state in re-
8 sponse to the update procedure not succeeding, wherein a rollback procedure is per-
9 formed to the qtree in the unstable rollback state and wherein the qtree transitions to the
10 done state in response to the rollback procedure succeeding;
11 performing a two step jump ahead procedure from the done state to the stable
12 state wherein a new coalesced base PCPI is exported comprising the qtree; and
13 whereby only a fixed number of PCPIs are consumed in updating the coalesced
14 PCPI.
- 1 2. The method of claim 1 wherein a qtree in the stable state corresponds to a source
2 at a point in time.
- 1 3. The method of claim 1 wherein a qtree in the unstable update state is being modi-
2 fied during an update procedure wherein changes are transferred from a source to a desti-
3 nation comprising the qtree.
- 1 4. The method of claim 1 wherein the done state signifies that a source has com-
2 pleted sending data during an update and the qtree is committed to completing the update.
- 1 5. The method of claim 1 wherein the fixed number of PCPIs comprises four PCPIs.

1 6. The method of claim 1 wherein the fixed number of PCPIs comprises a coalesced
2 base PCPI, a coalesced rollback PCPI, an intermediate jump-ahead PCPI and the new
3 coalesced base PCPI.

1 7. The method of claim 1 further comprising the step of transitioning to an unstable
2 uncoalesced state in response to a rollback procedure not succeeding.

1 8. A system for updating a qtree stored in a coalesced persistent consistency point
2 image (PCPI) of one or more qtrees, the system comprising:
3 a management agent adapted to perform an update procedure from a source to the
4 qtree, wherein the qtree transitions from a stable state to an unstable update state as the
5 update procedure commences; and
6 wherein the management agent is further adapted to transition the qtree from the
7 unstable update state to a done state in response to the update procedure succeeding.

1 9. The system of claim 8 wherein the management agent is further adapted to per-
2 form a two step jump ahead procedure to transition the qtree from the done state to the
3 stable state wherein a new coalesced PCPI is exported; and
4 wherein the two step jump ahead procedure transitions all qtrees in the coalesced
5 PCPI to the stable state.

1 10. A system for updating a qtree stored in a coalesced persistent consistency point
2 image (PCPI) of one or more qtrees, the system comprising:
3 means for transitioning from a stable state to an unstable update state as an update
4 procedure commences;
5 means for transitioning from the unstable update state to a done state in response
6 to the update procedure succeeding;
7 means for transitioning from the unstable update state to an unstable rollback state
8 in response to the update procedure not succeeding, wherein a rollback procedure is per-

9 formed to the qtree in the unstable rollback state and wherein the qtree transitions to the
10 done state in response to the rollback procedure succeeding;
11 means for performing a two step jump ahead procedure from the done state to the
12 stable state wherein a new coalesced PCPI is exported comprising the qtree; and
13 whereby only a fixed number of PCPIs are consumed in updating the coalesced
14 PCPI.

1 11. A method for tracking a set of organizational structures that are updated on a des-
2 tination system replica by changes transmitted from a source system comprising the steps
3 of:

4 establishing a stable state in which each of the organizational structures in the set
5 is consistent in the replica and free of update activity;

6 when updating the organizational structures with the changes, moving the organ-
7 izational structures into either a done state wherein the changes have been made to all of
8 the organizational structures in the set or an unstable state wherein the changes have not
9 been made successfully to at least one of the organizational structures;

10 when at least one of the organizational structures is in the unstable state, attempt-
11 ing a rollback to an earlier version of the organizational structures;

12 if the rollback is successful, taking a single persistent consistency point image
13 (PCPI) of the set organizational structures and if the rollback is unsuccessful, attempting
14 a rollback to an earlier version of the at least one of the organizational structures sepa-
15 rately and, if the rollback of the at least one of the organizational structures is successful,
16 then taking a PCPI all of the set of organizational structures including the rollback ver-
17 sion of the at least one of the organizational structures; and

18 from the PCPI, returning the set for organizational structures to the stable state.

1 12. The method as set forth in claim 11 wherein the step of attempting the rollback
2 includes periodically repeating the rollback attempt until all organizational structures are
3 returned to an earlier version from which the PCPI can be taken.

- 1 13. The method of claim 11 wherein the organization structures comprises qtrees.
- 1 14. The method of claim 11 wherein a fixed number of PCPIs are consumed.
- 1 15. The method of claim 14 wherein the fixed number of PCPIs comprises a coa-
2 lesced base PCPI, a coalesced rollback PCPI, an intermediate jump-ahead PCPI and a
3 new coalesced base PCPI.
- 1 16. The method of claim 15 wherein the coalesced rollback PCPI is only generated if
2 a rollback is attempted on one or more of the organizational structures.